**T07D01 – (7.1) Dynamic Equilibrium Notes**

Name …….

1. 7.1.1 Outline the characteristics of chemical and physical systems in a state of equilibrium. (2)
   a. What is different about an open system and a closed system?

   b. Equilibrium can be established only when one of the above situations occurs. Using a diagram show what happens to the $H_2O$ particles when in equilibrium in this system.
   c. Describe, using a diagram and explanation, how $Br_2$ can be in equilibrium:

| Situation | Water in Open System | Water in Closed System | Bromine in Closed System |
|---|---|---|---|
| **Diagram** | | | |
| **Explanation** | | | |

   d. Each of the above situations are in Physical Equilibria, explain what that means:

   e. The sign for equilibrium (⇌)is very important, describe why an IB moderator might mark you down for using a complete arrow (→)n accident:

   f. What is the difference between static equilibrium and dynamic equilibrium:

| Static Equilibrium | Dynamic Equilibrium |
|---|---|
| | |

   g. The dynamic equilibrium of soda can change when the pressure of a bottle is released, provide a diagram and explanation for each of the following situations

| | Closed Coke Bottle | Open Coke Bottle | Open Coke Bottle with Mentos | Previously opened (not closed) coke bottle in the sun |
|---|---|---|---|---|
| **Diagram** | | | | |
| **Explanation** | | | | |

h. How is chemical equilibrium different than physical equilibrium?

i. Two common examples are (1) the test for $Fe^{3+}$ ions in solution, and (2) the decomposition or formation of HI. Complete the following table for each situation:

| | **$Fe^{3+}(aq) + SCN^-(aq) \rightleftharpoons [Fe(SCN)]^{2+}(aq)$** | **$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$** |
|---|---|---|
| **Color Changes** | | |
| **How can the equilibrium be shifted?** | | |
| **How can the equilibrium be monitored?** | | |
| **If the reaction "lies to the right"** | | |
| **If the reaction "lies to the left"** | | |
| **When the reaction is in dynamic equilibrium, what are the rates?** | | |

j. In an example using $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$, demonstrate that the equilibrium is not dependent on where the reaction starts (favouring reactants or products):

| | **Starting with HI(g)** | **Starting with $H_2$ and $I_2$** |
|---|---|---|
| **Diagram** | | |

k. Explain why the concentrations of reactants and products are not equal even though they are constant:

l. Use the escalator analogy to describe how a reaction can "lie to the left" or "lie to the right":

m. I'm nice, so I put this chart on your notes for you ☺

| | **Feature of equilibrium state** | **Explanation** |
|---|---|---|
| 1 | Equilibrium is dynamic | Reaction has not stopped but both forward and reverse are in same rate |
| 2 | Equilibrium is achieved in a closed system | Prevents exchange of matter with surroundings, so equilibrium is achieved where both R and P can react and recombine |
| 3 | Concentrations of R and P remain constant at equilibrium | They are being produced and destroyed at an equal rate |
| 4 | At equilibrium there is no change in macroscopic properties | Refers to observable properties such as color and density. Do not change as they depend on [conc] of the components of the mixture |
| 5 | Equilibrium can be reached from either direction | The same equilibrium mixture will result under same conditions, no matter whether the reaction is started with all R, P, or mixture of both |